



Smart decisions for sustainable forest management

Co-creation of Forest-Climate nexus data

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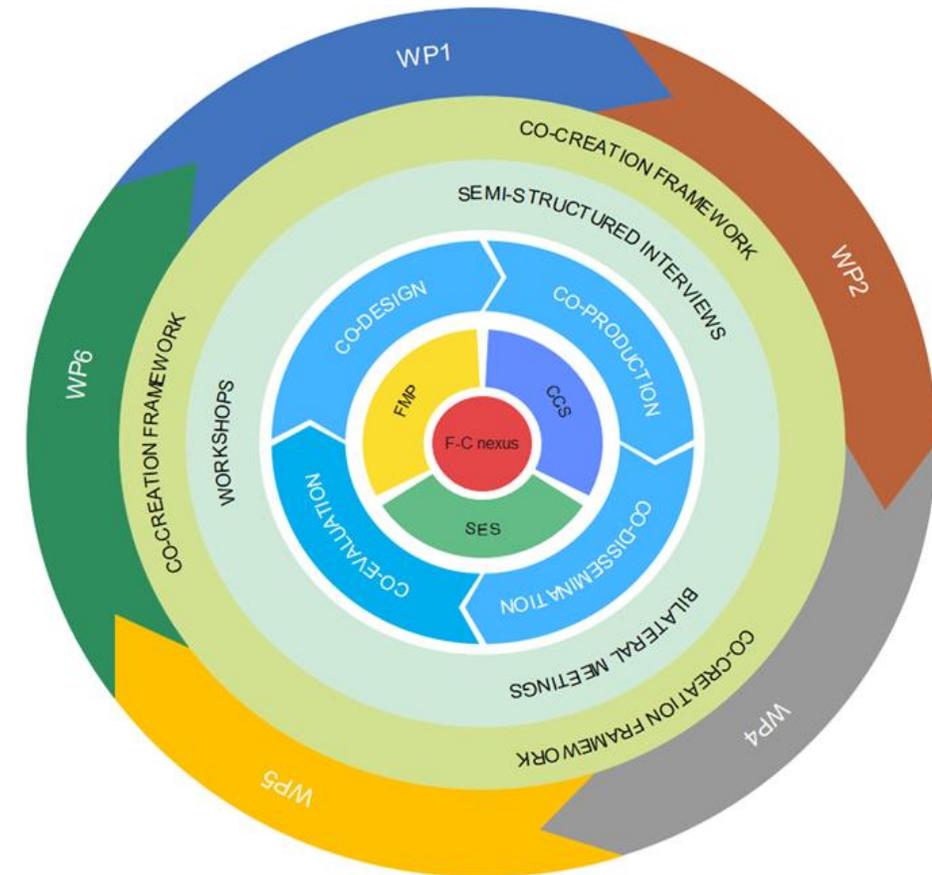
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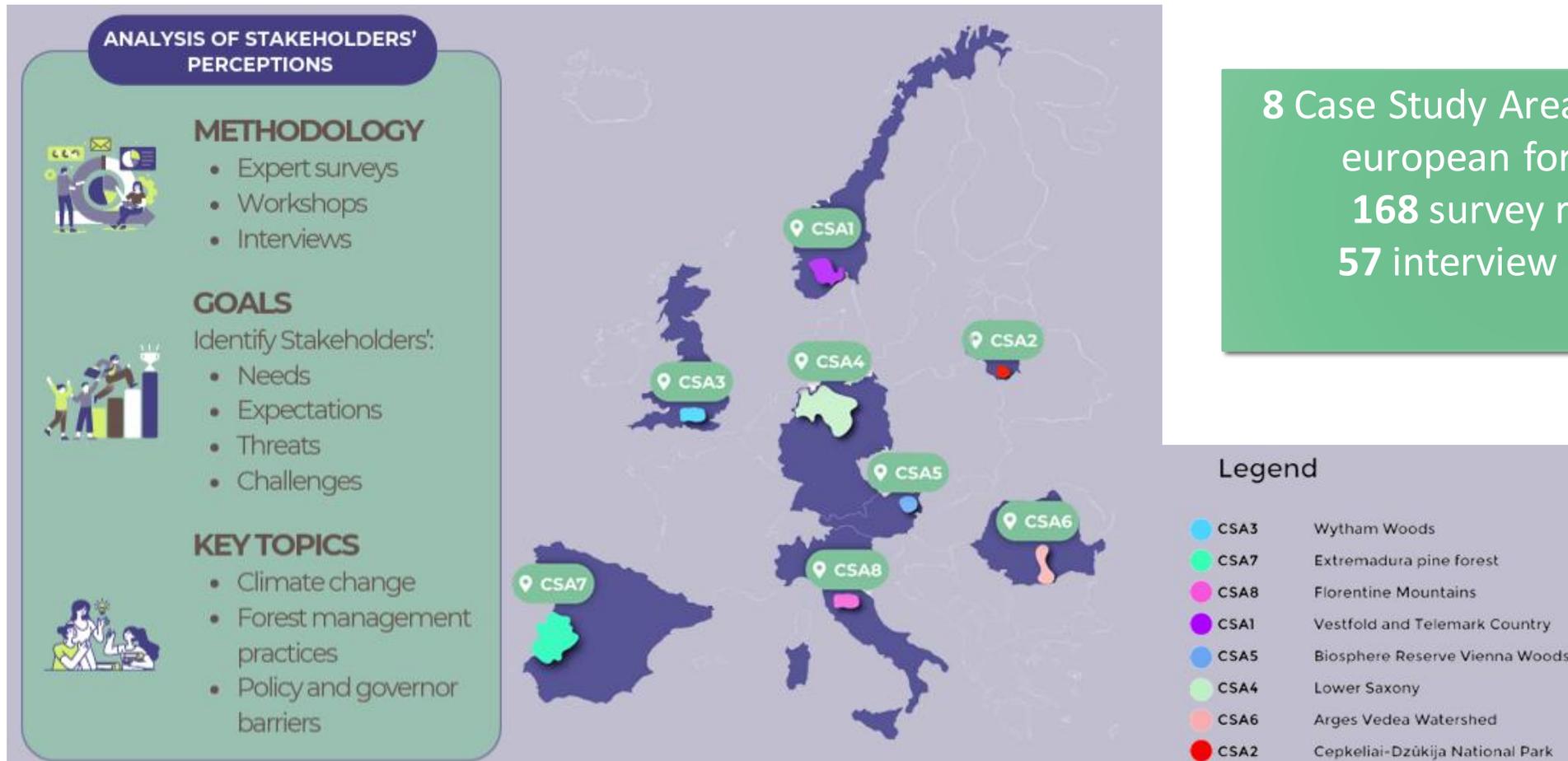
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Co-creation framework

- **Aim:** to provide information on how to engage stakeholders over the project lifetime and build trustful relationships, to facilitate the exchange between the science and local stakeholders, to ensure the way to transfer of knowledge from science to practice and to identify local narratives and existing needs in forest management practices.
- **Objectives:**
 - Raise awareness
 - Facilitate an improved understanding of local context and user needs and requirements
 - Empower stakeholders to develop and adopt appropriate measures for achieving their specific goals
 - Provide useful, usable and accepted outputs
 - Deliver useful information and guidance in addressing specific challenges
- **Co-creation framework:**
 - Common vision of stakeholder engagement process
 - Identify and categorize forest managers and other forest stakeholder (N ≈ 300)
 - Collect forest managers and other forest stakeholder requirements and expectations associated with the F-C Nexus



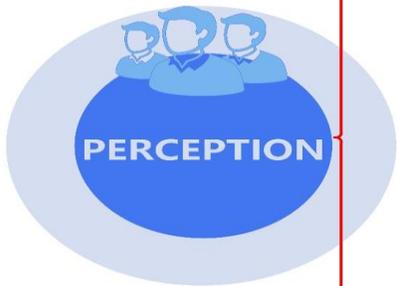
Methodological approach



8 Case Study Areas (covering all european forest types)
168 survey responses
57 interview responses



Forest stakeholders' perception and needs



CLIMATE



- **Temperature Increase**: Rising annual temperatures have led to warmer winters, hotter summers, and extended growing seasons. Earlier springs and delayed winters disrupt natural dormancy cycles
- **Precipitation Variability**: Rainfall patterns have shifted, with fewer but more intense precipitation events, leading to flash floods and longer droughts. Snowfall has declined, reducing groundwater recharge.
- **Extreme Weather Events**: Heatwaves, prolonged droughts, and strong storms (including wind events and hurricanes) are becoming more frequent, causing significant damage to forests.

FOREST MANAGEMENT



- **Adaptive Species Selection**: Transition towards tree species that are more drought- and heat-resistant, as traditional species (e.g., spruce and fir) struggle under new climatic conditions.
- **Flexible Planting and Harvesting Schedules**: Adjusting planting cycles due to variable rainfall and modifying harvesting strategies as ground frost periods shrink.
- **Soil and Water Conservation**: Implementing erosion control, improving drainage infrastructure, and maintaining forest vegetation to retain soil moisture.
- **Enhanced Pest and Disease Control**: Milder winters allow pests to survive, necessitating more rigorous monitoring and integrated pest management strategies.
- **Diversification and Resilience Building**: Promoting mixed-species forests and incorporating varied age structures to increase ecosystem resilience against climate stressors.

SOCIO-ECONOMIC



- **Economic Adaptation for Forest Owners**: Timber markets face challenges due to irregular wood supply, changing growth rates, and lower-quality timber from climate-stressed trees.
- **Increased Management Costs**: Infrastructure repairs (e.g., roads, culverts) after extreme weather events and additional investments in pest control increase operational expenses.
- **Workforce and Planning Adjustments**: Forestry operations must adapt to shorter winter harvest windows and shifting work schedules.
- **Risk and Policy Considerations**: Insurance mechanisms, subsidies, and risk assessments are becoming crucial for mitigating economic losses due to climate change.
- **Community and Livelihoods**: Rural economies reliant on forestry must diversify their income sources. Engaging local communities in sustainable forest management is key to long-term adaptation.

Obstacle(s) in optimizing climate protection for forests

Governance and Policy Issues

- *'Missing operational forestry laws / outdated.'*
- *'Legislative limitations to operate smoothly see: bureaucracy, procurement rules, redundancy fund, etc.'*
- *'Lack of legislative predictability (frequent changes in forestry legislation).'*
- *'Lack of interest of the political class in general for the forest.'*
- *'Lack of collaboration between the legislator and the private sector in the legislative process.'*

Economic and Financial Constraints

- *'Lack of funding and support for the conservation and maintenance of forests, as well as their biodiversity.'*
- *'Entrenched business models around monocultures'.*
- *'Lack of financial instruments to support forest owners/ industry in adopting climate protection measures for forests.'*



Awareness and Education

- *'Low awareness among forest owners and managers regarding the risks of climate change in forest management.'*
- *'The often-ideological approach, based on limited knowledge of forest dynamics and the climatic effects on forests, which translates into the maintenance of models and strategies no longer sufficient and adequate to the historical moment.'*
- *'Lack of public awareness through the media regarding forest climate protection.'*
- *'We have a problem of civic education, and this represents a significant barrier to optimizing climate protection.'*

Environmental and Ecological issues

- *'The reality of pests/disease driving decision making (e.g. removal of infected species, tendency to abandon diseased species and seek a replacement rather than adapt management).'*
- *Land fragmentation: 'Fragmentation and land pulverization, which together with the large share of "silent" owners, do not allow for effective forest planning even in terms of climate protection.'*

Key findings and conclusions





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